Asher Creek 319 Project
G12-NPS-02

Final Report

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1.0 Project Background

The Asher Creek 319 project focused on the 25,387-acre upper portion of the 38,000-acre Asher Creek tributary to the Little Sac River (HUC 10290106050005). The Little Sac River watershed covers 390 square miles, includes Fellows Lake and McDaniel Lake, and joins the Big Sac River to form Stockton Lake. The entire 2,000-square mile Sac River watershed is ranked third on the state's Unified Watershed Assessment (UWA). Vitally important to the city of Springfield, the Little Sac River watershed provides the majority of the city's drinking water supply. On any given day, 80 percent of the water used by 80,000 City Utilities of Springfield customers originates in the Little Sac River basin.

The Asher Creek watershed lies north of the city of Willard and east of the city of Walnut Grove in north central Greene County and south central Polk County. Land use in this watershed is primarily pasture/hay/forest land. There are an estimated 175 farms in the watershed with the average size near the Greene County average of 118 acres. Beef cattle and horses are the primary livestock raised in the watershed.

Geologically, the area has karst topography with limestone bedrock, numerous sinkholes, faults, caves, and losing streams. Soils are structured primarily of red clays and contain more than thirty-five percent rock fragments with the Goss/Wilderness series being the most predominate with fragipan soils common on ridgetops.

The 2000 U.S. Census indicates there are 790 households in the Asher Creek watershed, with a population estimated to be around 1,850 people.

A twenty-nine mile reach of the Little Sac River was placed on the 303(d) list in 1998 for fecal coliform contamination, for which a Total Maximum Daily Load (TMDL) for fecal coliform was approved in 2006. The Watershed Committee of the Ozarks (WCO) and City Utilities of Springfield conducted sampling in Asher Creek from 2003 until 2007. In 2009 the WCO and the Greene County SWCD developed a nine-element watershed management plan (WMP) entitled "The Upper Little Sac Watershed Management Plan". This plan, accepted by the Department on July 8, 2010, covers the upper half of the Little Sac Basin, including the Asher Creek sub-basin. Monitoring data from several previous studies including the Little Sac River TMDL and the Little Sac River Data Gap Analysis were used to identify priority sub-watersheds. In the WMP data from four locations on Asher Creek indicated high levels of impairment (E. coli). Consequently, the Asher Creek Basin was identified as a priority area for best management practices (BMPs) implementation and restoration in the Upper Little Sac WMP. Historically, no stand-alone water quality implementation project has focused on just the Asher Creek portion of the Little Sac basin.

1.1 Project Goals and Objectives

Asher Creek was initially approved as a two year project. Two of the proposed BMP practices traditionally can take as long as 6 months or more to complete. As a result, BMP goals were kept to what the District felt was an achievable level for such a short timeframe. Consequently, the project planned for the implementation of 3 prescribed grazing systems as well as 5 acres of riparian corridor exclusion. In addition, liming to correct pH deficiencies on 500 acres of pasture and hayland acres was added as a new practice for the area.
It is a well-established fact that improved grassland production filters and holds more nutrients, bacteria and sediment, thus reducing their occurrence in runoff. Improved grassland production through grazing management and pH deficiency correction has the added benefit of improving cattle production. Over the long term this gives landowners a positive cost-benefit ratio for the installation of these practices. It was hoped that cost-share assistance would spark the initial landowner interest and encourage producers to implement intensive grazing management systems, take soil samples for analysis and correct pH problems with their soil.

Implementing riparian corridor exclusion protects the riparian corridor and its habitat. This practice allows the existing vegetation to rest and regrow. The increased vegetation resulting from riparian corridor protection can potentially reduce sediment erosion by as much as 60-90%, which reduces the amount of nutrients, bacteria, chemicals, and animal waste entering the stream.
Livestock exclusion also prevents the animals from having unlimited access directly to the stream. When livestock have unlimited access to streams they deposit manure directly into the water, destroy the streamside vegetation and erode streambanks. Protected riparian corridors also provide escape and nesting habitat for birds and small animals, as well as shading the stream to reduce water temperature and increase dissolved oxygen.

1.2 Target Audience

Landowners, primarily livestock producers, were the targeted audience for the Asher Creek 319 project. Water quality monitoring data collected previously by the Watershed Committee of the Ozarks identified the area as a priority for restoration in the Upper Little Sac River WMP. Monitoring data showed that E. coli levels were far higher than levels allowed by the State of Missouri for whole body contact. This watershed is a sub-basin of the Little Sac River watershed and drains into Stockton Lake, a major public drinking water source.

In the watershed there are a considerable number of livestock operations. Because of this, and because one hundred percent of this hydrologic unit lays in a drinking watershed, and has moderate biologic impairment and a high potential for groundwater quality problems due to the karst geology, it was determined that

livestock producers were the primary audience for restoration efforts. This does not ignore the fact that there could be other factors resulting in impairment such as urban influences and on-site wastewater system contamination as sampling results may have indicated.

1.3 Activities Conducted to Achieve Project Goals and Objectives

Activity	# Produced	Cost
2012 Kick-off Event and Farm Tour	1 event	$111.30
2013 Field Day and Fence Workshop	1 event	$0.00

Because of the short duration and small size of this project, these events proved sufficient to meet the goals of the project.

1.3.1 Products Produced

Product	# Produced	Number Distributed
Project Flyer	1	200
Newsletter Article	2	4000
Promotional Mailer	3	600
Power Point Presentation	1	1
Landowner Survey	1	25
QAPP	1	3

(Please provide your project manager 3 replicates (hard-copy or electronic) of any products produced under this grant Refer to Section 5.0.)

2.0 Evaluation Measures

As part of this project a landowner survey was developed and handed out to the attendants at our second field day. A more thorough effort to survey the landowners in the area was planned to be completed in the third year of the project. However, that was not realized due to the early termination of the grant. The success of the project could also be measured by the amount of landowner participation in the program. All of the original goals for the project were met or exceeded in the original timeframe. The grant was having so much success at

obligating BMP funds that a one year extension was added with an additional $53,500.00 in funding primarily for BMPs.

2.1 Water Quality Monitoring Activities

The primary goal of the Asher Creek water quality monitoring effort was to quantify the load level of the measured impairments in the watershed. There have been no extended, weekly monitoring efforts conducted so far in this watershed. The secondary goal of the monitoring effort was to measure the effectiveness of the project's proposed BMPs. However, BMP implementation was limited due to time and funding constraints; consequently, the size of the watershed was reduced in order to more narrowly focus the restoration efforts.

The Watershed Committee of the Ozarks performed all field data collection as stated in the QAPP, see attached. Upon collection, the WCO field staff delivered the samples to the Ozarks Environmental and Water Resources Institute (OEWRI) laboratory at Missouri State University (MSU) for analysis. Data was collected for stream flow conditions, bacteria load, total phosphorus and total nitrogen levels, and optical brighteners. Field monitoring was used to gather the required data. Flow conditions were recorded at the time of sampling. Water quality samples were collected as grab samples at six different locations along Asher Creek. Samples were delivered to the OEWRI laboratory at MSU and analyzed by approved methods described in the QAPP for bacteria, including E. coli, total phosphorus, total nitrogen and optical brighteners.
In-stream monitoring occurred at six different bridges across Asher Creek and its tributary. These locations were spaced throughout the watershed in an effort to gather data from above and below BMP sites. Because livestock and forage production-related BMPs were the primary focus of the restoration efforts in the watershed an attempt was made to not locate the sampling points near large areas of timber. The following list of sites indicates where sample collection occurred:

Site AC 01-Asher Creek at Z Highway north of Willard
Site AC 02-Asher Creek west of Farm Rd. 52
Site AC 03-Asher Creek north of Farm Rd. 81
Site WG 04-Tributary from Walnut Grove on Farm Rd. 4
Site AC 05-Asher Creek at State Highway BB
Site AC 06-Asher Creek at 560th Rd. near the Little Sac River confluence

Water quality grab samples were gathered weekly from the 6 designated sites on Asher Creek between April 1 and October 31 each year of the grant. Monthly samples were taken the rest of the year, outside of the above date range.
Over the eighteen month period of water quality sampling, 343 samples were collected. This is considerably less than was planned for the project and can be attributed to the fact that Asher Creek was completely dry in many places during the drought of 2012.

For the complete discussion of the sampling plan please see the attached Final Report by OEWRI and the attached QAPP.

The following methods were taken from the attached Final Report by OEWRI.
Load Duration Method Objectives
~~*2.1.1*~~ OEWRI determined nonpoint source pollution loads for all six sampling sites during the project period by using the water quality monitoring data produced during the project.
~~2.1.2~~ Load Reduction Calculations and Summaries
Laboratory Analysis
Samples were analyzed the OEWRI Laboratory at Missouri State University. Samples were analyzed for TN and TP using a Genesys 10S UV-Vis Spectrophotometer. Average detection limits were 0.2 mg/L TN and 0.003 mg/L TP with accuracy within the range of + or – 20%. The IDEXX Quanti-Tray/2000 system is used to analyze water samples for the presence of total coliform and E. coli. The detection limit of this machine is 1 MPN/100mL with accuracy of + or – 20%. Analysis of OB was competed using a Hitachi FL-2500 fluorometer with a detection limit of ≤0.5 mg/L with an accuracy of + or – 20%.

Hydrological Monitoring
Stage was recorded at sites AC03 and AC06 every 15 minutes over the 20 month monitoring period using Solinst Levelogger Gold and Baralogger Gold leveloggers. The barologger was used to compensate for barometric pressure changes. Raw data was downloaded from the levelloggers onto a laptop during each sampling event.

Flow conditions were recorded at the time of sampling with a Marsh McBirney Flow- Mate 2000 portable flow-meter. These data were used to create discharge rating curves at each site to estimate flows at different stream levels over the monitoring period. Additional flow measurements were collected using a SonTek FlowTracker Acoustic Doppler velocity meter to verify and calibrate rating curves (Photo 8). The highest calibration flows were estimated for both sites using Manning's equation in Hydraflow Express software (Intelisolve 2006). Two regression lines were used to best represent the data split at the 0.3 m stage. Flow frequency curves were created using the levelogger readings over the monitoring period and the discharge rating curves.

Load Calculations
Flow-weighted loads over the monitoring period were calculated using the load duration method. This method combines the flow frequency curves from the hydrologic monitoring and nutrient rating curves from the water quality monitoring portion of the project. Nutrient concentrations are allocated to specific flows representing 1% increments based on the percentage of time that flow occurred over the monitoring period. Then by multiplying the

concentrations and the flow a load representing each increment of time is calculated and the sum represents the load from the entire monitoring period. Nutrient loads were compared to established eutrophic thresholds used in the Ozarks (Dodds et al. 1998, MDNR 2001).
Please see the attached QAPP and OEWRI Final Report for a complete discussion of all these pollutants, methods and sources.

Pollutant		Method Used
E. Coli	Average concentrations ranged from 3 to 14 times higher than state standards	IDEXX Quanti-Tray /2000
Coliform	All sites exceeded 2,000 MPN/100ml	IDEXX Quanti-Tray /2000
Total Nitrogen	Site AC03 2.63mg/L Site AC06 3.73 mg/L Average flow weighted concentration	Genesys 10S UV-Vis Spectrophotometer
Total Phosphorus	Site AC03 0.042mg/L Site AC06 0.048mg/L Average flow weighted concentration	Genesys 10S UV-Vis Spectrophotometer
Optical Brighteners	Please see the attached OEWRI Final Report for a discussion on this pollutant	Hitachi FL-2500 fluorometer

Annual nutrient loads by site.

Site	Ad km^2	TP Avg. Con. mg/L	TP Load Mg/yr	TP Yield $Mg/km^2/yr$	TN Avg. Con. mg/L	TN Load Mg/yr	TN Yield $Mg/km^2/yr$
AC03	38.7	0.042	0.81	0.02	2.63	50.7	1.3
AC06	91.9	0.048	2.0	0.02	3.73	154	1.7

2.2 Other Environmental Field Activities Conducted

~~2.2~~In addition to the weekly sampling events taken for the project a field log was maintained by the technician collecting samples. This log documented site conditions at the time of sampling and noted any unusual items that could have an impact on the project. A digital copy of this log is attached in the appendix.

~~2.4~~2.3 Measuring Knowledge and/or Behavior Changes

The Greene SWCD has completed 6 watershed based projects over the last 16 years. That experience has shown that for various reasons, behavior changes in large groups of landowners can be extremely difficult to achieve even for long term fully funded grants. If knowledge transfer and behavioral changes are measured by the rate of landowner participation and interest in a project then the Asher Creek project was very successful. Part of that was due to the fact that a concerted effort was made in the early stages of the Project to involve several of the prominent landowners in the Watershed. When those landowners completed BMP practices with the Project the word quickly spread about the benefits of these practices. This lead to a greater transfer of information in the community and more landowners coming forward wishing to participate. As a result the project obligated all of its initial BMP funding as well as the majority of its additional monies. Landowners are currently still working on projects in the watershed that are being funded by other sources, directly as a result of the interest generated by this Project. All of the original goals for the project were met or exceeded. The Project completed the three goaled grazing systems by November of the second year. In additional four more grazing systems were contracted and then were canceled due to the early project termination. The pH correction practice was very successful in that 498.4 acres of a 500 acre goal were completed. This particular practice was only held back by the fact that several of the surrounding rock quarries ceased producing ag lime due to economic difficulties. Those quarries have now resumed limited production and landowners are calling interested in signing up for the program.

3.0 Partners and Roles

Partner	Role
USDA Natural Resources Conservation Service	Assisted with kick-off tour and project field days. Provided computer access, planning software and a vehicle for field visits.
Missouri State University, OEWRI, Ozarks Environmental and Water Resources Institute Laboratory	Performed all sample analysis and calculation of loads according to QAPP and EPA guidelines.
WCO, Watershed Committee of the Ozarks	Performed all stream sample collection according to OEWRI SOP and QAPP

3.1 Committees Formed

There were no formal committees formed in this project as it was viewed as implementing the approved Watershed Management Plan and therefore working under the auspices of that steering committee. However, several prominent landowners were consulted in the creation and the initial implementation of the project. These landowners were vital to the success of the project and will continue to be leaders in the ag community.

4.0 Project Overview

Even with the difficulties of the drought of 2012 this project has been one of the most successful projects that the SWCD has ever completed based on landowner interest in BMP implementation. It is extremely unfortunate that the District has suffered a staffing shortage that has required it to terminate this project early. The projects original BMP goals were all met or exceeded in the original time allowed for the project. In addition, a one year Project extension was sought and granted by the Department in order to fund more BMPs due to the increasing level of landowner interest. The Asher Project was initially funded as a two year project with a relatively small amount of funding for BMP implementation, in a watershed that had never before had any type of watershed project completed in it. Goals were kept as conservative as possible due to the short nature of the project and the small amount of funding. Consequently it was something of a shock to see the large amount of landowner interest in this watershed. It is believed that a combination of having several of the prominent landowners in the watershed involved in the project as well as working in an "underserved" part of the county led to the success of the project. Unfortunately it was the loss of staff by the District that has forced this project to terminate early and prevented the Project from completing the additional goals.

From a sampling standpoint, the project was challenged by the severe drought of 2012. Sample collection all but halted for a period of time in June, July and August 2012, due to little or no flow at several points along Asher Creek. However, 2013 rainfall was much better and a complete sample period was obtained for that season. Please see the attached OEWRI Final Report for a further discussion on sampling.

Due to the short timeframe of this project and the limited amount of BMP's funded for the watershed size, it was difficult to establish a measureable load reduction in this watershed. Part of the difficulty was that there was little existing baseline data available for the area. Essentially the first 18 months of the sampling project were necessary to establish the baseline data. That baseline data has now been established as well as a large number of interested landowners have been identified. A second, longer term project, say on the order of four to five years is now needed to prove BMP efficiency. This project would require a considerable amount of BMP funding and another round of sampling at the end to determine any load reductions in the watershed.

4.1 Department of Natural Resources Role

The Department of Natural Resources played a significant role in the initial development of the Project. Jane Davis and Trish Reilly both provided a considerable amount of valuable input and guidance as the grant was developed. As the Project moved into the implementation phase Jane, Trish and Greg Anderson all three helped guide the project. Jane and Trish both attended the kick-off event and toured the watershed to visit the 6 sample collection sites. Their assistance has been much appreciated.

4.2 Suggested Changes to Project Efforts

Several key points have been learned from this project. The first is to keep the watershed size as small as possible so that it is more manageable. Many times it seems that projects are too large for the limited amount of BMPs to have a measureable effect. In this case, the chosen watershed was roughly 25,000 acres. For the small amount of BMP funding and the time allowed for implementation, it was not feasible to obtain more than what would be considered a baseline look at the pollutant levels in Asher Creek let alone establish a measured reduction in pollutant load.

A second important point is to establish who the key landowners are in the watershed and get their buy-in at the outset. Without the support of these prominent producers in the area the odds of having a successful project are diminished.

5.0 Attachments

All items produced during the course of this project shall be submitted along with this report. Items, such as those listed below, shall be submitted electronically on a CD ROM.

Please submit two copies of the CD ROM. One CD ROM will be retained at DNR with the project file, while the other will be forwarded to the U.S. EPA as part of the project closeout procedures.

- *Photo or photo journal*
- *Water Quality Data (Excel format)*
- *Copies of products produced during the course of the project (e.g., QAPP, brochures, newsletter articles, newspaper clips, presentations, reports, etc.).*